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**An exploratory study of associations between Australian-Indian mothers' use of
controlling feeding practices, concerns and perceptions of children's weight and
children's picky eating**

Abstract

Aim: This cross-sectional study explores associations between migrant Indian mothers' use of controlling feeding practices (pressure to eat, restriction and monitoring) and their concerns and perceptions regarding their children's weight and picky eating behaviour.

Methods: Two hundred and thirty mothers with children aged 1-5 years, residing in Australia for 1-8 years, participated by completing a self-reported questionnaire.

Results: Perceptions and concerns regarding children's weight were not associated with any of the controlling feeding practices. A positive association was noted between pressure feeding and perceptions of pickiness after adjusting for covariates: children's age, gender and weight-for-age Z-score. Girls, older children, and children with higher weight-for-age z scores were pressure fed to a greater extent.

Conclusions: This study supports the generalisation of findings from Caucasian literature that pressure feeding and perceptions of pickiness are positively related.

Keywords: culture, feeding practice, migrant Indian, picky eating, pressure feeding.

Introduction

For a comparable BMI, Indians have at least 3-5% higher body fat compared to Caucasians and may have higher risk of developing chronic disorders such as Type-II diabetes mellitus and cardiovascular diseases than Caucasians.¹ A British national report highlighted that prevalence of overweight-obesity among Indian boys (26%) and girls (31%) was comparable to Caucasian boys (30%) and girls (31%) aged 2-15 years.² Although Indians are the fourth largest immigrant population in Australia³, data on obesity among Indians in Australia was not identified for either children or adults. Moreover, there is limited research on factors associated with obesity within the migrant Indian population.

In recent times, maternal feeding practices have been explored in relation to childhood obesity.^{4,5} Maternal feeding practices may influence children's food preferences, eating behaviour and weight in the short and long-term.⁶ 'Controlling' feeding practices in particular (pressure to eat, restriction and monitoring) have been extensively studied.^{7,8} Pressure and restriction may override children's sensitivity towards hunger and satiety cues and in turn may lead to excess intake and weight gain. Therefore, modifying these practices could promote healthy weight.⁶

Factors that may influence controlling feeding practices are maternal perceptions of children's weight and eating behaviour. For instance, perceptions about children being underweight⁷ and overweight^{7,8} have been associated with pressure and restriction, respectively. Maternal perceptions of pickiness have been associated with coercive feeding practices.^{6,9} Additionally, the influence of mothers' cultural background^{10,11} on their perceptions of children's weight and (picky) eating behaviours, and its influence on their feeding practices⁸ cannot be ignored. For example, Huang *et al.* reported that Chinese-American mothers were more likely to

practice dietary restriction than Caucasian-American mothers.¹¹ However, research has been predominantly conducted with American, British⁷ and Australian⁸ mothers, and specific ethnic groups like African-American¹² and Latino-American mothers.¹³ Generalisation of findings from one ethnic group to another is unclear, and therefore, it is inappropriate to assume that previously observed relationship between perceptions of children's weight, picky eating and controlling feeding practices⁸ will apply to Indians. Thus, this cross-sectional study explored migrant Indian mothers' use of controlling feeding practices and whether these were associated with their perceptions regarding children's weight and picky eating.

Methods

Using a convenience sampling technique 230 Indian mothers were recruited. Participants were approached through online social networks, networks of friends and families, Indian associations, media networks, worship places and retail outlets. Eligibility criteria were: mothers born in India, >18 years of age, facility with English, have at least one child 1-5 years old as these are critical years when healthy eating patterns may develop¹⁴ and reside in Australia for 1-8 years. The time frame was selected based on studies by Kannan *et al.* who suggested that Indian immigrant mothers living in the US for one to eight years may benefit from receiving nutritional intervention in the host country regarding appropriate child-feeding.^{15,16}

Following ethical clearance from '[removed for blind peer review]' (Approval number: 1000000943), mothers completed an anonymous questionnaire either online (Key Survey software, version 7.4) or a hardcopy. Completion of the questionnaire indicated informed consent. From a pilot study conducted on 15 eligible mothers, ten preferred to complete the online version. From a total of 234 questionnaires received, four did not meet the inclusion criteria and 77% of the eligible questionnaires were completed online. The study questionnaire was developed using the following validated questionnaires.

*The Child Feeding Questionnaire (CFQ)*¹⁷: The selected restriction and monitoring scales were composed of eight and three items, respectively. An item that captured monitoring practice (*How much do you keep track of the snack food: potato chips, Doritos, cheese puffs that your child eats?*) was modified (*How much do you keep track of the salty food: potato chips, chevda that your child eats?*). The word 'snacking' was changed to 'salty' as it is not generally used by Indians and instead of 'Doritos' Indian snack item called 'Chevda' (fried

flaked rice-chickpea paste) was incorporated. The response options for restriction and monitoring scale ranged from: (1) Disagree to (5) Agree and (1) Never to (5) Always, respectively. The mean scale scores were calculated and higher scores indicated greater use of the feeding practice. In the study, reliability for the restriction and monitoring scale was $\alpha=0.65$ and $\alpha=0.94$, respectively.

*The Comprehensive Feeding Practices Questionnaire (CFPQ)*¹⁸: The selected pressure to eat scale consisted of four items. Two items which captured ‘coercive’ feeding practices (*My child should always eat all of the food on his/her plate; if my child says, I’m not hungry, I try to get him/her to eat anyway*) were identical to the pressure to eat scale of the CFQ.¹⁷ The other two items (*If I did not guide or regulate my child’s eating, she would eat much less than she should; I have to be especially careful to make sure my child eats enough*) in the CFQ focused on regulatory aspects of child-feeding. The CFQ measures behavioural aspects of child-feeding explicitly within the context of childhood obesity whereas; the CFPQ measures multiple feeding practices. Thus, the other two items (*If my child eats only a small helping, I try to get him/her to eat more; when he/she says he/she is finished eating, I try to get my child to eat one-two more bites of food*) in the CFPQ captured ‘coercive’ feeding practices. The response option ranged from: (1) Disagree to (5) Agree. In the present sample the Cronbach α for the scale was 0.53.

The NOURISH questionnaire^{5, 19}: A single question (*Do you think your child is a picky or fussy eater?*) assessed perceptions of pickiness. Response options were: Very picky-Somewhat picky-Not picky-Not sure. Similar to previous research^{5,9,19,20}, for analyses, responses were categorised as ‘Picky’ (Very picky-Somewhat picky) vs ‘Not picky’. A single item (*Do you think your child is...?*) assessed perceptions of children’s weight. Response

options were: Underweight-Healthy weight-Somewhat overweight-Very overweight-Don't know. Only one mother selected 'Somewhat overweight' and none selected 'Very overweight'. Thus, 'Somewhat overweight' was combined with 'Healthy weight' and the responses were dichotomised as 'Underweight' vs 'Healthy weight'. A single question (*How worried are you about your child's weight at the moment?*) assessed concerns about children's weight. Response options were: Not at all-A little-Moderately-Very-Don't know. For analyses, responses were categorised as 'Not concerned' (Not at all) vs 'Concerned' (A little-Moderately-Very). The 'Not sure' and 'don't know' response options were coded as missing data. Variables were dichotomised acknowledging the distribution of the data and for consistency across the three variables.

Self-reported anthropometric data: Mothers self-reported their own and their children's current height and weight. Mothers' BMI (kg/m^2) was computed.²¹ For children, weight-for-age (WFA) Z-scores²² was calculated as 35% of mothers did not provide their child's height. The use of WFA Z-scores (requires weight data) minimised double measurement errors by excluding self-reported height measurements.

Maternal and child characteristics: The children's characteristics comprised of age, gender, place of birth (Australia vs India), number of children (single child vs siblings) and breastfeeding history (ever vs never breastfed). Maternal characteristics included age, length of residence in Australia, education dichotomised as tertiary degree completed (Bachelors/Masters/PhD) vs not completed (Not completed /completed high school/undergraduate diploma); occupation as working/studying fulltime vs not (housewife/on leave/unemployed/part-time work/part-time study/others/casual work); family income as above ($\geq \$70,000/\text{year}$) vs below ($< \$70,000/\text{year}$) the national median income²³,

religion as following vs not following Hinduism (Jain/Christian/Muslim/Buddhist/others). Maternal weight perceptions as perceiving themselves as highly underweight/underweight/healthy weight vs overweight (highly overweight/overweight). 'Highly underweight/underweight' was selected by few mothers (n=7) thus combined with 'Healthy weight'.

The mothers' concerns and perceptions regarding their children's weight and pickiness were treated as the independent variables. Controlling feeding practices (pressure to eat/restriction/monitoring) as the dependent variables and were normally distributed. Associations between the three independent variables were tested using the Pearson's chi-squared test. Significant associations ($p < 0.05$) between the predictor and the outcome variables were identified using the Independent samples t- test. Bivariate associations between covariates and feeding practices were examined using Pearson's correlation and Independent samples t-test. Hierarchical regression models examined if the association between independent variables and feeding practices remained robust after controlling for selected covariates. Selected covariates ($p < 0.1$) were entered in the first block and independent variables in the second block.

Checks for multicollinearity were performed by computing variance inflation factor which as recommended were below 10 for all variables.²⁴ Checks for multivariate outliers and influential data points were performed by computing Mahalanobis and Cooks distance, respectively. As recommended, for all cases Mahalanobis values were below 25, and Cook's values were below one, hence, all cases were included in the final analyses.²⁴ Analyses were conducted using SPSS version 18.

Results

The participants' characteristics and mothers' attitude regarding weight and pickiness are highlighted in Table 1. The youngest mother was 25 and the oldest was 43 years of age. Duration of residence ranged from one year, three months to seven years, six months. Mean scores and standard deviations for controlling feeding practices are displayed in Table 2. No differences ($p=0.14$) were noted between mean scores of participants completing the hardcopy or the online version of the questionnaire (data not shown).

Bivariate analyses between independent variables showed that children's weight concerns were associated with perceptions about children being underweight ($\chi^2 (1) = 61.2, p<0.001$). No association was observed between perceptions of pickiness and perceptions about children being underweight ($\chi^2 (1) = 0.13, p=0.72$) or concerns regarding children's weight ($\chi^2 (1) = 0.95, p=0.33$). Independent samples t-test showed that a significant positive association existed only between pickiness and pressure feeding (Table 2).

Bivariate associations between selected covariates and mean score for pressure feeding are shown in Table 3. Results showed that in association with pressure feeding only children's age, gender and WFA Z-scores had p values <0.1 . The overall model to explain the use of pressure feeding was significant ($F (4,183) = 6.0, p<0.001, R^2 = 0.12, R^2_{Adj} = 0.09$). Perceptions of pickiness significantly improved the overall fit of the final model (R^2 change = 0.02, $F_{change} = 4.3, p = 0.04$). Adjusted results indicated that mothers were more likely to pressure feed if they perceived their children as picky eaters (3.2 ± 0.8 vs non-picky: $2.9 \pm 0.8, \beta = 0.15, p = 0.04$). Girls (3.3 ± 0.8 vs boys: $3.0 \pm 0.9, \beta = 0.20, p = 0.006$), older children ($\beta = 0.23, p = 0.001$), and children with higher WFA Z-scores ($\beta = 0.19, p = 0.007$) were pressure fed to a greater extent.

Discussion

This study explored the association between migrant Indian mothers' perceptions and concerns regarding their children's weight, picky eating and controlling feeding practices. Mean scores for pressure, restriction and monitoring were similar to that obtained by Caucasian mothers with children aged 2-6 years.^{8,12,25} Results showed that children perceived as picky were more likely to be pressure fed, after adjusting for children's age, gender and WFA Z-scores.

The association observed between pickiness and pressure feeding was consistent with the literature. In a cross-sectional study, American children aged 2-3 years perceived as picky eaters were pressure fed to a greater extent.⁹ However, 'picky eating' is subjective, reflecting a range of maternal attitudes and child behaviour patterns. Perceptions of pickiness may not always be accurate. American mothers offered unfamiliar food 3-5 times before deciding their children aged 4-24 months disliked the food. Although depending upon their age, children may require 8-15 offerings to accept new foods.⁹ Therefore, mothers may prematurely conclude their children are picky eaters based on a few episodes of refusal. Additionally, refusal of familiar foods may indicate satiety^{5,19} but could be misinterpreted as pickiness. The cross-sectional design precludes claims about causality. However, the accuracy of perceptions of pickiness influencing coercive practices is noteworthy. The use of coercive practices is a concern due to its association with negative outcomes on children's eating, such as lowered interest in food among Australian children aged 2-4 years⁸; negative comments about food among American children aged 3-5 years²⁶ and higher satiety responsiveness and slowness in eating among British children aged 7-9 years⁷, which could be perceived as picky eating and in turn lead to higher pressure feeding.⁹ This emphasises the need for raising awareness on positive child-feeding practices.

Secondary findings highlighted higher pressure to be associated with higher WFA Z-scores. Contrary, American²⁷ and British⁷ mothers' use of coercion has been associated with lower BMI Z-scores. Although similar to the present study, British mothers' use of pressure moderated the relationship between early and later weight gain; high WFA Z-scores at 0-6 months were associated with subsequent higher WFA Z-scores at 6-12 months.²⁸ Children in the present study were older (1-5 years) than children (0-12 months) studied by Farrow & Blissett.²⁸ However, Indian children are commonly fed by their mothers (passive feeding) beyond five years of age.²⁹ This practice may interfere with children's sensitivity towards food cues and influence their WFA Z-scores.²⁸ Due to the cross-sectional design it is unclear whether WFA Z-scores are antecedent to, or consequences of pressure feeding.

Another interesting finding was that girls were more likely to be pressure fed. In contrast, a cross-sectional study showed that rural Indian mothers were more likely to use coercive feeding with boys aged 3-24 months.³⁰ Within the non-affluent strata boys may be 'preferred' over girls due to complex social reasons.³¹ However, in the present study almost all (95%) mothers had tertiary education and findings may reflect on contextual differences between rural India and metropolitan Australia.³² Nevertheless, an explanation for higher coercive feeding with girls is not readily apparent; hence replication of the association and further exploration is required.

Contrary to earlier studies^{7,8} perceptions and concerns regarding children's weight were not associated with any of the controlling feeding practices. This may be because most children were perceived as healthy weight (77%) and indeed the majority were of a healthy weight according to self-reported weight-for-age Z-score (83%). Although a significant proportion of

mothers were concerned about their children's weight (49%), weight concerns were not associated with feeding practices. The finding requires further investigation. It can be concluded that, Indian mothers' perceptions and concerns of their children's weight do not appear to drive their use of controlling feeding practices. Future research should focus on the influence of culturally-specific factors such as role of extended family particularly the mother-in-law³³ and cultural beliefs¹⁰ on mothers' feeding practices. For example, 75% participants followed Hinduism and Hindu culture emphasises that food is a sacred commodity and it is considered disrespectful to leave food on plate.³⁴ Thus, pressure feeding could be a culturally driven practice leading to higher WFA Z-scores. This hypothesis can be evaluated in future studies by assessing cultural beliefs in conjunction with feeding practices.

Lastly, the prevalence of overweight and obesity (11%) noted in the present study for Indian children aged 1-5 years was comparatively lower than for Australian children but higher than for urban-affluent children in India. The Australian national report (n=1122) highlighted that 21% of boys and 18% of girls aged 2-3 years were overweight or obese.³⁵ The Indian national report (n=46655, age: <5 years) indicated that 3% of urban-affluent children were overweight or obese.³⁶ In the present study anthropometric data were based on maternal-report, thus self-reporting errors and biases (e.g. social desirability bias) cannot be ruled out, but which has in the past been shown to be reliable.³⁷ Alternatively, previous research has shown that in developed nation's higher maternal education is associated with lower weight status of children.³⁸ Therefore, the lower overweight prevalence rate noted in the present study may well reflect the anthropometric status of children of recently immigrated educated Indians in Australia. This is because similar to the present study (95% completed tertiary degree); Indian immigrants in Australia tend to be highly educated due to current immigration policy being biased towards higher education attainment (www.immi.gov.au). It is also noteworthy that

according to the national data, Indian born Australians are three times more likely than all other Australians to have a bachelor's degree or higher.³⁹

Other limitations included using single item to measure concerns and perceptions of weight and pickiness. However, these items have high face validity and have been used in earlier research.^{5,9,19,20} Other than perceptions of pickiness other eating behaviours such as satiety/food responsiveness⁴⁰ in association with feeding practices are warranted. The convenience sampling technique limits the findings to educated migrant Indian mothers with children aged 1-5 years. However, the target group was of interest as childhood obesity is a rising concern within the migrant Indian population.² To our knowledge, the study was first to trial sub-scales of validated questionnaires^{17,18} in a migrant Indian sample. Similar to the study, Cronbach's α of 0.53 for coercive feeding has been observed in previous research⁴¹ and values between 0.50 to 0.60 are considered acceptable for early research.⁴²

In summary, the study was one of the first to establish an association between Indian mothers' perceptions of pickiness and pressure feeding practices. Coercion was not associated with perceptions or concerns regarding children's weight. Alternatively, other culturally-specific variables (role of mother-in-law, cultural beliefs) may further explain Indian mother's use of pressure. These findings may have implications for future interventions aiming to promote positive feeding practices in migrant Indian mothers.

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Table 1: Mothers self-reported characteristics and concerns and perceptions of weight and children's eating behaviour (n=203)

Variables	%(<i>n</i>) or Mean±SD
Maternal characteristics	
Age (years)	32±3.3 <i>n</i> =173
BMI	24±3.9 <i>n</i> = 186
BMI cut offs	
Underweight ($\leq 18.50 \text{ kg/m}^2$)	3(6)
Healthy weight ($18.51\text{-}24.9 \text{ kg/m}^2$)	59(110)
Overweight/obese ($\geq 25.0 \text{ kg/m}^2$)	38(70) <i>n</i> = 186
Length of residency in Australia (years)	4±1.9 <i>n</i> =106
Education (tertiary degree)	95(191) <i>n</i> =202
Family income $\geq \$70,000/\text{year}$	59(116) <i>n</i> =197
Religion(Hindu)	75(153)
Occupation (working/studying fulltime)	39(80)
Child characteristics	
Number of children (one child)	63(128)
Ever breastfed	99(229)
Age (months)	34±14.0
Gender (female)	51(103)
Birth place (India)	25(50) <i>n</i> = 199
Weight for age Z-scores	0.24±1.8 <i>n</i> =195
Weight for age Z-scores categories	
Underweight (below -2.00)	6(13)
Healthy weight (at median)	83(161)
Overweight/obese (above 2.00)	11(21) <i>n</i> = 195
Maternal concerns and perceptions of weight and children's eating behaviour	
Mothers' own weight perceptions	
Healthy weight-underweight	66(133)
Overweight-highly overweight	34(68)
Perceptions of children's weight	
Underweight	22(51)
Healthy weight-somewhat overweight	77(175) <i>n</i> =228
Concerns about children's weight	
Concerned (not concerned)	49(110) <i>n</i> =228
Picky eaters (non-picky eaters)	74(161) <i>n</i> =217

Italicised n value denotes missing data

Table 2: Independent sample t-tests between grouping variables and controlling feeding practices

Feeding practices	Perception of pickiness				Children's weight concerns				Children's weight perceptions			
Mean scores (Mean±SD)	Picky	Non- picky	Mean difference (95% CI)	p value	Concerned	Not concerned	Mean difference (95% CI)	p value	Under weight	Healthy weight	Mean difference (95% CI)	p value
[†] Pressure to eat (3.1±0.9)	3.2±0.9	2.9±0.8	0.3 (0.02-0.6)	0.04	3.1±0.8	3.2±0.9	-0.2(-0.4-0.09)	0.21	3.2±0.9	3.1±0.8	0.06(-0.2-0.3)	0.67
[‡] Restriction (3.5±0.8)	3.4±0.7	3.5±0.7	-0.03(-0.3-0.2)	0.81	3.5±0.6	3.5±0.8	-0.09(-0.3-0.1)	0.44	3.5±0.7	3.5±0.7	0.04(-0.2-0.3)	0.75
[‡] Monitoring (3.9±1.0)	3.9±1.1	4.2±0.9	-0.3(-0.6-0.04)	0.09	4.0±1.0	3.9±1.0	0.1(-0.1-0.4)	0.34	3.7±1.1	4.0±1.0	-0.3(-0.6-0.03)	0.08

[†]The Comprehensive Feeding Practices Questionnaire¹⁸

[‡]The Child Feeding Questionnaire¹⁷

Table 3: Bivariate analysis between covariates and pressure feeding practices

Covariates	Pressure feeding practices	
[†] Continuous variables	r value	p value
Mother's age	-0.01	0.86
Mother's BMI	-0.03	0.68
Children's age	0.2	0.01
Weight for age Z-scores	0.1	0.07
**Categorical variables	Mean difference (95% CI)	p value
Education (tertiary degree)	0.3(-0.2-0.8)	0.27
Occupation (working/studying fulltime)	-0.2(-0.4-0.08)	0.20
Family Income (below median income)	-0.1(-0.4-0.1)	0.29
Religion(Hindu)	0.06(-0.2-0.3)	0.66
Own weight perceptions (under/healthy weight)	-0.1(-0.4-0.2)	0.40
Gender (female)	-0.2(-0.5-0.02)	0.08
Number of children(one child)	0.04(-0.2-0.3)	0.73
Birth place (India)	0.1(-0.2-0.4)	0.48
Ever breastfed	0.1(-1.6-1.9)	0.87

[†]Pearson's correlation^{*}Independent sample t-tests

p<0.1 selected for regression analysis